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G2J
Selected US specifications from IPC sub-class
A61B

(54) Ophthalmoscope having an aspheric condenser lens

(57) An ophthalmoscope has a condenser 4 including at least one lens element 6 having at least one optically effective aspheric surface which may be part cylindrical.

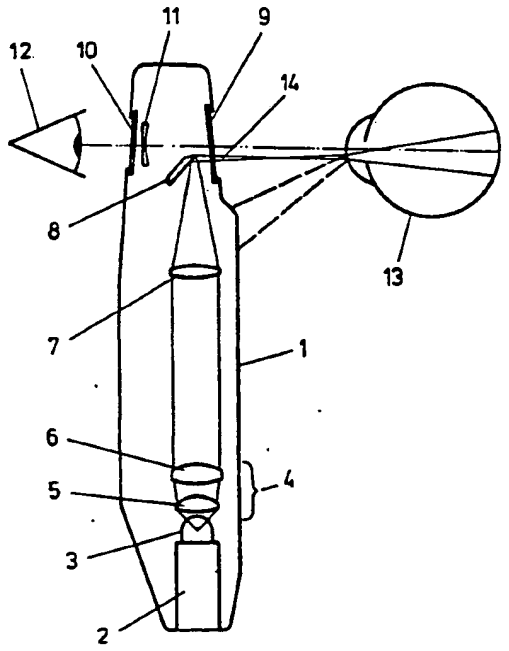

Fig. 3a

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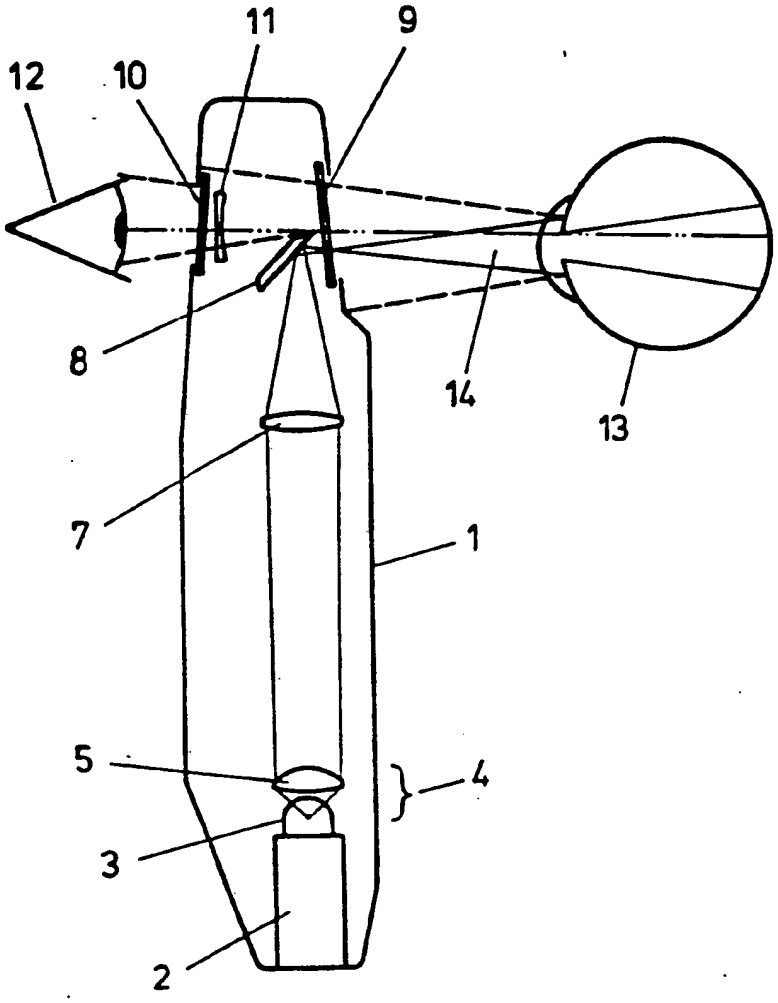

Fig. 1a

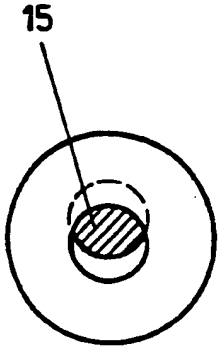

Fig. 1b

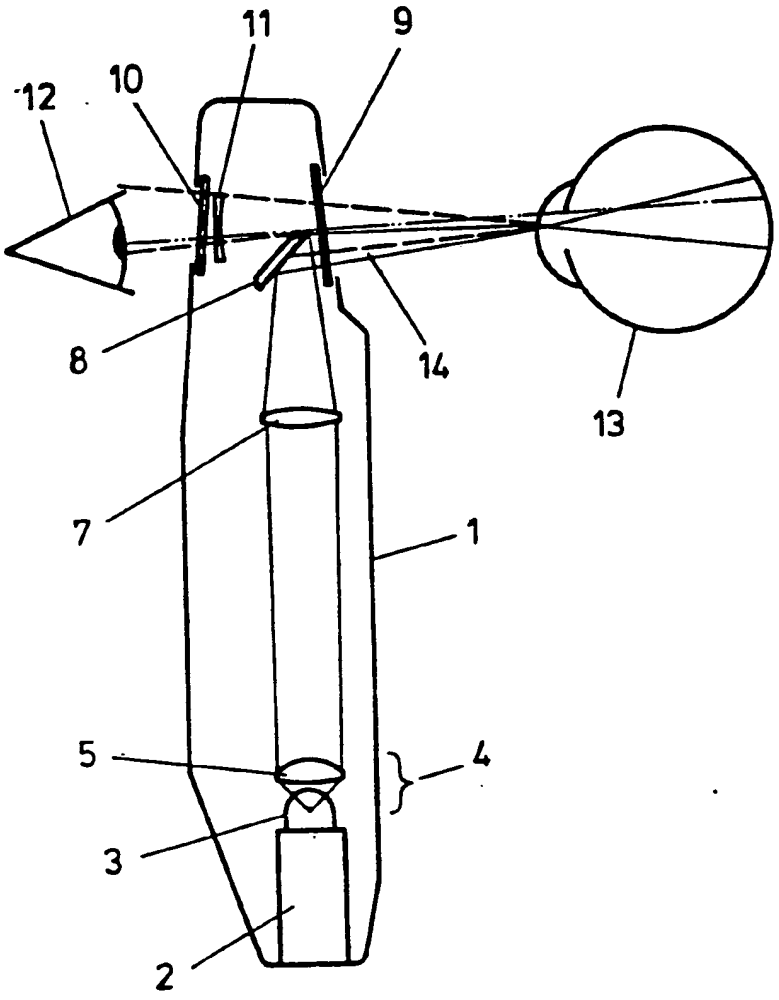

Fig. 2a

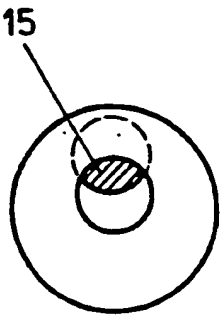

Fig. 2b

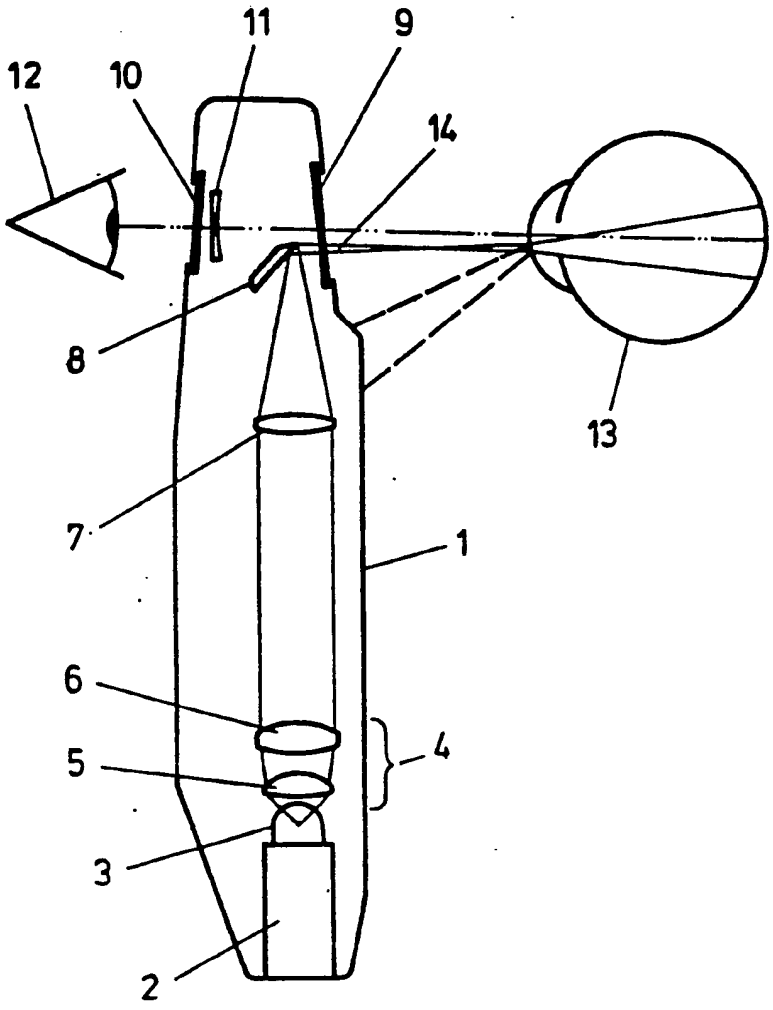

Fig. 3a

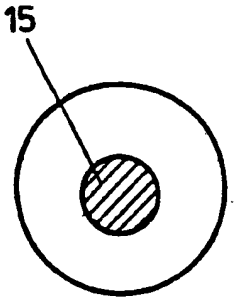

Fig. 3b

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OPHTHALMOSCOPE

This invention relates to an ophthalmoscope.

A known ophthalmoscope comprises a housing containing an incandescent lamp, a condenser or condenser system consisting of at least one lens, an objective lens and a deflecting mirror. Light from the incandescent lamp is passed in a beam through the condenser (system) and the objective lens and is deflected by the deflecting mirror as an illumination beam through an exit window of the housing for illuminating the eye of a patient. An entrance window is arranged in the housing opposite the exit window for enabling an observer to view the eye of the patient directly through the two windows and through a further lens positioned in the housing close to the entrance window, the line of view through the housing being over the upper edge of the deflecting mirror.

With this known ophthalmoscope, if the pupil of the eye of the patient is open wide, a sufficiently large region of the retina is illuminated by the illumination beam. However, if the pupil of the eye of the patient is small, only a small proportion of the light from the illumination beam passes to the retina - especially if the focal point of the lens system of the ophthalmoscope is situated in the vicinity of the deflecting mirror. Furthermore, not only is the intensity of illumination low at the fundus of the eye, but the light falling on to the eye of the patient is reflected back by the iris and cornea in a broad beam on to the eye of the observer rendering examination difficult if not impossible. If, on the other hand, the illumination beam is concentrated in the vicinity of the pupil of the eye of the patient, the parallax angle between the illumination beam path and the observation beam path, which is relatively large when the pupil of the patient is small, means that only a narrow, substantially

oval-shaped region of the fundus of the eye is illuminated. Furthermore, this illuminated region is displaced eccentrically from the centre of the fundus of the eye.

The present invention seeks to provide an ophthalmoscope which is able to illuminate as large a region as possible of the fundus of the eye of a patient with the best possible utilization of the available light, the aim being to avoid or suppress as far as possible reflections from the eye of the patient back on to the eye of the observer.

According to the present invention an ophthalmoscope comprises a source of light and an optical system including a condenser for concentrating light from the light source into an illumination beam for illuminating an eye of a patient, wherein the condenser comprises at least one optical element having at least one optically effective aspheric surface.

Conveniently a single optical element is provided having a part cylindrical aspheric surface.

An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1a is a longitudinal cross-section through a known ophthalmoscope,

Figure 1b is a representation of the fundus of an eye of a patient as seen by an observer when using the ophthalmoscope of Figure 1a,

Figure 2a is a longitudinal cross-section through another known ophthalmoscope,

Figure 2b is a representation of the fundus of an eye

of a patient as seen by an observer when using the ophthalmoscope of Figure 2a,

Figure 3a is a longitudinal cross-section through an ophthalmoscope according to the invention, and

Figure 3b is a representation of the fundus of an eye of a patient as seen by an observer when using the ophthalmoscope of Figure 3a.

Figure 1a shows a first known ophthalmoscope comprising a housing 1 in which is housed a lamp mounting 2 holding a light source in the form of an incandescent lamp 3. In front of the incandescent lamp 3 there is situated a condenser 4 (or a condenser system) consisting of a lens 5 (or a plurality of lens elements). After the condenser 4, in the path of the illumination beam, there are situated an objective lens 7 and a deflecting mirror 8 for deflecting light from the light source through an exit window 9 of the housing. A further window 10 is disposed in the housing 1 opposite the exit window 9 and a further lens 11 is positioned in the housing 1 close to the window 10. An eye of an observer is able to observe an eye of a patient through the window 10 and the lens 11, over the upper edge of the deflecting mirror 8 and through the exit window 11.

When the pupil of the eye 13 of a patient is opened wide, a sufficiently large region of the retina is illuminated by the illumination beam 14. However, when the pupil of the eye 13 of the patient is small, only a small proportion of the light from the illumination beam passes to the retina of the patient. This is particularly so when the focal point of the lens system is situated in the vicinity of the deflecting mirror 8 as shown in Figure 1a. Furthermore, with the known ophthalmoscope of Figure 1a, not only is the intensity of illumination low at the fundus of the eye, but the light falling on to the eye 13 of the patient is reflected by the iris and cornea rearwardly in a

broad beam on to the eye 12 of the observer (as indicated in Figure 1a by the region bounded by the dashed lines). As a result of this reflection, examination of the eye of the patient is made more difficult if not impossible.

A second known ophthalmoscope is shown in Figure 2a and is similar to the ophthalmoscope shown in Figure 1a except that the optical system is such that the illumination beam 14 is concentrated in the vicinity of the pupil of the eye 13 of the patient (the same reference numerals have been used in Figures 1a and 2a to identify similar items). On account of the parallax angle, which is necessarily greater for the eye of the observer when the pupil of the patient is small, only a very narrow, substantially oval-shaped region 15 (see Figure 2b) of the fundus of the eye is visible as illuminated. This region 15 is displaced upwards into an eccentric position as compared with the illuminated region 15 shown in Figure 1b for the ophthalmoscope shown in Figure 1a.

Figure 3a shows an ophthalmoscope according to the invention which is similar in many respects to the known ophthalmoscopes shown in Figures 1a and 2a and where possible similar reference numerals have been used to identify similar items of the ophthalmoscopes. The essential difference in the design of the ophthalmoscope shown in Figure 3a is that the condenser 4 not only comprises at least one spherical lens 5 but also a lens 6 having an aspheric optically effective surface. Typically the aspheric surface of the lens 6 is in the form of a part cylinder.

The lens 6 provides the illumination beam 14 with an at least approximately tubular form between the deflecting mirror 8 and the eye 13 of the patient, the illumination beam, over a relatively long length of the beam path, being very narrow at least in one direction. In consequence of this the parallax angle between the illumination beam path

and the observation beam path can be kept small so that, for the eye 12 of the observer, an almost circular illuminated region 15 (see Figure 3b) becomes visible on the fundus of the eye 13 of the patient. Furthermore the light of the illumination beam is well utilized so that the region 15 is not only comparatively large but is also illuminated with a comparatively strong intensity. Light which is reflected at the cornea and iris of the eye 13 of the patient is not reflected back on to the eye of the observer but is reflected laterally and downwardly (as indicated by the dashed lines in Figure 3a).

CLAIMS

1. An ophthalmoscope comprising a source of light and an optical system including a condenser for concentrating light from said light source into an illumination beam for illuminating an eye of a patient, wherein the condenser comprises at least one optical element having at least one optically active aspheric surface.

2. An ophthalmoscope according to claim 1, in which the at least one optically active aspheric surface is part cylindrical.

3. An ophthalmoscope constructed and arranged substantially as herein described with reference to, and as illustrated in, Figures 3a and 3b of the accompanying drawings.

4. An ophthalmoscope having a condenser disposed in an illumination beam path, wherein the condenser has at least one optical element with at least one optically effective aspheric surface.

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